Improving Semi-Supervised Learning in Generative Adversarial Networks Using Variational AutoEncoders

Faheem Moolla[1], Terence L. van Zyl[2], and Hairong Wang[1]

[1] University of the Witwatersrand, Johannesburg GT 2000, South Africa
1234085@students.wits.ac.za, hairongwng@gmail.com
[2] University of Johannesburg, Johannesburg GT, 2092, South Africa
tvanzyl@uj.ac.za

Abstract. Semi-supervised learning is a deep learning paradigm that has shown significant value for general machine learning and generative modelling. To date, Generative Adversarial Networks (GANs) still suffer from challenges related to mode collapse and other sources of instability. Further, little research has been done to investigate how incorporating semi-supervised learning (using SGAN) and pre-training (using VAE) into GAN training might alleviate some of these challenges. To this end, this study proposes SSGAN, a combination of VAE and SGAN, to tackle some of these challenges. Our extensive qualitative and quantitative analysis shows that the proposed approach significantly improves the stability of GAN training and the quality of generated images. Further, the results indicate that this can be done with relatively few additional labelled examples. In conclusion, continued research and exploring foundation models and other semi- and self-supervised learning mechanisms will likely lead to further improvements.

Keywords: GAN · VAE · Semi-supervised GAN.